FINAL
OU2 SUBSURFACE IM/IRA SCIENTIFIC NOTEBOOK PLAN
SOIL VAPOR EXTRACTION PILOT TESTS

Rocky Flats Plant

(Operable Unit No. 2)

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

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TABLE OF CONTENTS

LIST OF TABLES

1.0 PURPOSE

This Scientific Notebook Plan (SNP) outlines the required experimental/research approach to record methods and data for the OU-2 Interim Measure/Interim Remedial Action (IM/IRA) Soil Vapor Extraction (SVE) Pilot Test. This SNP does not apply to activities that can be conducted effectively using procedures or instructions; it supports Environmental Management Department (EMD) activities in lieu of procedures.

The governing Work Plans for this SNP are the Final Pilot Test Plan Soil Vapor Extraction Technology, Subsurface Interim Measure/Interim Remedial Action (EG&G 1993a) and the Final OU2 IM/IRA Implementation and Operation Plan, Soil Vapor Extraction Pilot Test (EG&G 1993b).

1.1 BACKGROUND

A Phase I Remedial Investigation (RI) was conducted at Operable Unit No. 2 (OU2) in 1987 to define the nature and extent of contamination for the purpose of conducting a baseline risk assessment or identifying feasibility study (FS) remedial alternatives. A Phase II RI was started in October 1991 to further characterize OU2. In addition to the RIs for OU2, the Department of Energy (DOE) has prepared several Interim Measure/Interim Remedial Action Plans (IM/IRAPs) to address groundwater, surface water, and soil contamination at OU2.

In September 1992, DOE released a final Subsurface IM/IRAP to investigate the removal of volatile organic compound (VOC) contamination from three areas within OU2. Specifically, the SVE technology would be pilot tested within, or adjacent to, suspected VOC source areas in the 903 Pad, Mound, and East Trenches.

1.2 PROJECT OBJECTIVES

The SVE pilot study will be used to assess the potential for SVE to remove VOC contamination suspected in the subsurface in the East Trenches Area. If SVE is determined to be a viable remedial technology, the pilot study will provide information to support evaluation of SVE as a remedial action

alternative for subsurface contamination at the East Trenches as part of a corrective measures study/feasibility study (CMS/FS) for OU2.

2.0 SCIENTIFIC NOTEBOOK PLAN SUMMARY

This SNP outlines operational aspects of the OU2 IM/IRA SVE Pilot Test. Installation of the system is effectively covered by approved EM Operating Procedures. The mobile SVE unit operations are covered by the Operations and Maintenance Manual (RTG 1993). The SVE monitoring activities are summarized in the Final Pilot Test Plan, Soil Vapor Extraction Technology, Appendix D, Table D-1 (EG&G 1993a). This SNP will address activities in Table D-1 for which the EM Operating Procedures have yet to be written.

2.1 PILOT TEST PLAN

The SVE pilot test operations are divided into the following phases: system operations (SO) testing, pilot testing, and sustained operations. SO testing will ensure that the SVE system is operating as designed prior to conducting the pilot tests. The pilot tests will determine the range of operating conditions for various system configurations. This information will determine the operating configuration yielding the maximum contaminant removal to be used during the sustained operations period. The decision to conduct sustained operations will be based on the ability of the system to successfully remove VOCs from the subsurface. The sustained operation will be conducted if the VOC removal rate of any one of the pilot tests is greater than 1 pound per day. This sustained operation will be used to estimate the system's projected cumulative and individual (alluvium and sandstone) contaminant removal rates, and each individual radius of influence. This information will be plotted versus time and used to estimate projected contamination removal rates. This data will be evaluated, along with the system operating costs, to determine the benefit of returning to the East Trenches Area IHSS 110 pilot test site for IM/IRA operation (final project phase).

2.2 SYSTEM OPERATIONS TESTING

Following installation of the wells and SVE pilot equipment, SO testing procedures will be initiated to verify the proper design and operation of the system. This will involve an inspection of the system components.

2.3 PILOT TESTING

After completion of the SO testing, the pilot tests will be initiated. These tests will be of relatively short duration and will be designed to determine the range of operating conditions that can be achieved by various system configurations and the optimal operating conditions for sustained operations of the SVE system. In addition, the pilot tests will be used to estimate the capacity and changeout requirements for the granular activated carbon (GAC) and high efficiency particulate air (HEPA) units. Information gathered during the pilot testing will be maintained in a scientific notebook and reported biweekly to the EG&G project manager. The time required to conduct the pilot tests is expected to be approximately four to six weeks.

The following subsections outline the pilot tests to be performed following system SO testing. There will be a total of nine pilot tests, and each test will include one to three discrete runs. The nine pilot tests are listed below:

- Pilot Test No. 1 - Initial Vapor Treatment System Performance
- Pilot Test No. 2 - Alluvium System Performance
- Pilot Test No. 3 - Sandstone System Performance
- Pilot Test No. 4 - Concurrent Groundwater Extraction and Sandstone System Performance
- Pilot Test No. 5 - Concurrent Alluvium and Sandstone System Performance
- Pilot Test No. 6 - Alluvium Passive Air Inlet Performance
- Pilot Test No. 7 - Sandstone Passive Air Inlet Performance
- Pilot Test No. 8 - Alluvium Forced Air Inlet Performance

- Pilot Test No. 9 - Sandstone Forced Air Inlet Performance

Actual running times will be based on the time required to achieve steady state vacuum pressure distribution in the subsurface. The pilot tests will be run until the steady state condition is achieved. If this condition is established before the minimum operating time has expired, the test will be continued for the minimum operating time for that test.

The measurements made during these tests will be used to evaluate air permeability of individual strata and to estimate the time required to reach steady state operation in each stratum as noted in the Final Test Plan (EG&G 1993a).

2.4 SAMPLING AND MONITORING

This section will describe the sampling and monitoring procedures for the different media. These procedures are discussed in more detail in the Final OU2 IM/IRA Implementation and Operation Plan (EG&G 1993b). The following activities will be recorded in the Scientific Notebook:

- Soil gas collection
- Soil gas monitoring
- Extracted groundwater collection
- Groundwater monitoring
- 10,000-gallon tank sample collection
- In-line flow measurements
- Pressure

TABLE 2-1
SUMMARY OF MANUAL SAMPLE/MEASUREMENT FREQUENCY

Sample/Measurement	Frequency
Soil Gas Samples[1]	
AV1	1 per 4 hours
SV1	1 per 4 hours
Extracted Groundwater[2]	
SV1	1 per 4 hours
SI1	1 per 4 hours
10,000-Gallon Tank Sample	As tank becomes full
In-Line Flow[1]	1 per 4 hours
Subsurface Soil Pressure	
AV1	1 per 4 hours
AI1	1 per 4 hours
APM1	1 per 4 hours
APM2	1 per 4 hours
APM3	1 per 4 hours
SV1	1 per 4 hours
SI1	1 per 4 hours
SPM1	1 per 4 hours
SPM2	1 per 4 hours
Granular Activated Carbon (GAC)	After GAC is spent

[1] Samples will be manual when both wells are used in conjunction, Pilot Test No. 5.
[2] Groundwater will be extracted in Pilot Test Nos. 3, 4, 7, and 9.

- GAC sampling

2.4.1 Soil Gas Collection

Soil gas is collected and monitored throughout each test and the sustained operation. Soil gas is collected from four different locations on the SVE unit. These locations are illustrated in Figure 6-1 and drawings in Appendix A, Final Pilot Test Plan (EG&G 1993a):

- Each vent well head (AV1 and SV1) when both wells are working in conjunction, and from the knockout pot when one well is in operation
- After the primary blower (B1)
- After the first GAC column (GAC 1)
- After the second GAC column (GAC 2)

Soil gas is normally collected from the different lines located in the gas sampling cabinet. When one well is in operation (either AV1 or SV1), the gas sampling cabinet is used. When both wells are used in conjunction (Test No. 5 and the sustained operation), two samples will be collected at each well head using a portable pump. The frequency of the manual samples is listed in Table 2-1. For each pilot test, the sample ports in the gas sampling cabinet are sampled using the following procedure:

- Start gas sampling pump.
- Flush system by allowing the pump to run for 2 minutes without opening the sample port.
- Connect filter inlet of SUMMA sampling canister to sample port.
- Open the filter inlet valve and the sample port and allow SUMMA canister to fill.

- Close the sample port.
- Open the next sample line to be sampled and repeat the previous steps until all sample lines have been sampled.

When both wells (AV1 and SV1) are in operation, the following sampling procedure is used:

- Connect the portable sample pump to the sampling point on the AV1 extraction piping.
- Open sampling point, start pump and purge line.
- Connect the pump to the filter inlet of SUMMA sampling canister.
- Fill the SUMMA canister.
- Disconnect pump and close sampling point.
- Repeat above steps for SV1 sampling point.

2.4.2 Soil Gas Monitoring

Soil gas will be monitored with an HNu or equivalent at the sample port in the gas sampling cabinet. After each sample is taken from its respective line, a Tedlar bag is placed on the sample port and the bag is filled with soil gas. Once the bag is filled, the HNu is used to take a real-time reading on the sample line. This process is repeated for each remaining sample line until all sample lines have been monitored.

2.4.3 Extracted Groundwater Collection

Groundwater will be collected and monitored during tests where the sandstone vent is in operation. Groundwater is extracted and monitored from sandstone wells SV1 and SI1 through the use of two submersible pumps. The following section describes how groundwater is collected and how monitoring of groundwater will occur.

Groundwater evacuation is regulated in SV1 and SI1 through the use of a globe valve located at each well head. Once the determined flow is set, groundwater collection from SV1 and SI1 is as follows:

- Open sample port located on the extraction line from the submersible pumps to the 10,000-gallon storage tanks.
- Fill four 40-ml glass VOA vials.
- Fill one 1-L polyethylene bottle for metals analysis.
- Fill one 125 ml polyethylene rad screen bottle.
- Fill three 1-gallon bottles for total rads analysis.
- Fill one 250 ml amber glass bottle for tritium analysis.
- Close sample port from wells.
- Containerize and label samples in accordance with SOP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples.

2.4.4 Groundwater Monitoring

Groundwater monitoring consists of taking groundwater level measurements. Two piezometers will be installed, one in SV1 and one in SI1. These piezometers are designed to use a pressure transducer. This pressure transducer will record an initial value based on where the water column is in the well at the beginning of the test. Based on whether water level rises or falls, the pressure transducer will produce a reading based upon the weight of the water column. This system is installed so the well can be sealed preventing the introduction of outside air and the reduction of the system vacuum.

2.4.5 10,000-Gallon Tank Sample Collection

The 10,000-gallon waste water tanks will be sampled as they become full. Sampling environmental liquids from the 10,000-gallon liquid storage tanks will be performed in accordance with draft SOP FO.20 (not approved), Sampling of Liquids and Solids From Environmental Materials Containers; Section 5.0, Sampling Procedures; and Section 5.2.4, Sampling Liquids. This draft SOP describes the responsibilities and qualifications of personnel performing the sampling, health and safety considerations, sampling equipment and procedures, and documentation of sampling events.

2.4.6 In-Line Flow Measurements

Operation of the mobile SVE includes the sampling of different media (Sections 2.4.2 and 2.4.3) and the collection system operational parameters. System operational parameters include flow rate, temperature, relative humidity, pressure, radiation, and GAC capacity estimation. Flow rate, temperature, and relative humidity are automatically collected and sent to the system datalogger for access via a computer.

However, when both wells are operating concurrently, a pitot tube is installed in each well to measure flow rate. The pitot tube will directly measure the relative flow rate from each well by producing a differential pressure in the air stream between the static and total pressure. From this value, an air stream velocity is calculated. Once the velocity of the air stream is known, the relative flow rate is calculated by multiplying the air velocity by the cross-sectional area of the pipe. Using the relative

flow rates calculated for each extraction well, the flow rate from the wells as calculated above will be divided to provide the flow rate estimated from each well.

2.4.7 Pressure

Pressure is monitored from various points throughout the mobile unit. These monitor points are:

- Dilution air line
- Vapor manifold
- After blower B-1
- After GAC 1
- After GAC 2
- Stack
- Before and after each HEPA filter

These pressure measurements are made within the mobile SVE trailer and automatically collected and sent to a datalogger for access with a computer.

Additionally, subsurface soil gas pressure will be monitored for each test. This pressure measurement will be taken by hand using a hand held digital manometer. The measurement locations are listed in Table 2-1. The following procedure will be followed for subsurface pressure monitoring at all sandstone/alluvial pressure monitoring probes:

- Zero manometer to atmospheric pressure.
- Place manometer on nipple located at the top of each pressure monitoring probe.
- Open stop cock and let manometer equalize for approximately 30 seconds.
- Take reading and close stop cock.

- Repeat procedure for the remaining pressure monitoring probes.

2.4.8 GAC Sampling

GAC samples will be taken from the entire vertical extent of the vessel contents, as possible. The samples will be collected with a sample thief.

The sample thief is used to collect relatively undisturbed solid samples. A sample thief is a long stainless-steel tube with openings along its length. The tip of the tube slot is sharpened to allow the thief to cut a core of sample material when it is rotated. The procedure for sampling GAC with a sample thief will be as follows:

- Decontaminate equipment prior to use in accordance with SOP FO.3 General Equipment Decontamination.

- Monitor vessel prior to sampling for VOCs and radiological activity in accordance with SOP FO.15, Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs), and SOP FO.16, Field Radiological Measurements.

- Insert the decontaminated sample thief into the vessel at a 0° to 45° angle from vertical to minimize sample spillage. Keep a minimum 30 cm (1 foot) of tubing above the top of the container.

- Rotate the sample thief once or twice clockwise.

- Slowly withdraw the thief from the vessel.

- Transfer the sample from the thief to a stainless-steel bowl on plastic sheeting using a spatula and/or brush if needed.

- Field screen the sample for VOCs in accordance with SOP FO.15, Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs).

- Provided the GAC is not wet, screen the sample for radiological activity in accordance with SOP FO.16, Field Radiological Measurements. If the GAC is wet, the Ludlum 12-1A will not provide useful data. The Health & Safety Specialist will be consulted to evaluate whether an equipment smear is appropriate.

- Repeat the sampling near the same depth at a minimum of two other points to obtain a representative composite sample of the vessel contents.

- Composite the samples from the vessel in accordance with Sample Compositing Procedures, described below.

When sampling from vessels, a minimum of three subsamples from each vessel will be obtained and composited according to the procedures outlined below. The three samples will be taken at three different points that are approximately an equal distance apart. The three subsamples from one vessel will be composited into one sample, as detailed below.

Individual GAC samples will be placed in a stainless-steel bowl on a plastic sheet (8 feet x 8 feet minimum size). These samples will be screened for VOCs and radiological activity in accordance with SOP FO.15, Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs), and SOP FO.16, Field Radiological Measurements. If there is a positive reading for VOCs, EG&G personnel will be consulted for a decision regarding GAC disposition. After the samples have been screened for radiation and VOCs, they will be combined in a stainless-steel bowl or pan.

Compositing will be done by stirring the GAC with a stainless-steel scoop or spoon in an appropriately sized stainless-steel bowl or pan. The GAC will be scraped from the sides and bottom, then rolled to the center and mixed. The sample will then be quartered. Each quarter of the sample will then be mixed individually. Each quarter will then be rolled to the center of the mixing bowl or pan and the entire sample mixed together. This procedure will be repeated as necessary to provide

a homogeneous sample before being placed in the sample container(s). At a minimum, the sample will have a uniform color, and all of the clumps will be broken up. After the remainder of the sample has been composited according to the procedures outlined above, the sample will be transferred to an appropriate sample container using a scoop. The sample container(s) will be sealed, labeled, and packaged in accordance with SOP FO.13, Containerizing, Preserving, Handling and Shipping of Soil and Water Samples. Any remaining sample portions will be placed back in the original vessels from which they were collected.

3.0 PERSONNEL

The personnel installing equipment, performing system operation, and providing oversight will be geologists, chemical engineers, environmental engineers, mechanical engineers, chemists, or field technicians with an appropriate amount of applicable field experience or on-the-job training under the supervision of a qualified person. All personnel will attend Rocky Flats QA Training. Additionally, all personnel will have Scientific Notebook System (SNS) training as part of SO testing.

3.1 PRINCIPAL INVESTIGATOR (PI)

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4.0 EQUIPMENT

The use of system operational equipment for the OU2 IM/IRA SVE pilot test is covered in the Final OU2 IM/IRA Implementation and Operation Plan (EG&G 1993b) and the Operations and Maintenance Manual (RTG 1993). Monitoring equipment will be covered by this SNP. Manufacturer's instructions for this equipment will be maintained in the field trailer.

MONITORING EQUIPMENT

- Hand-held Digital Manometer
- HNu or equivalent calibrated in accordance SOP FO.15, Photoionization Detectors (PIDs), and Flame Ionization Detectors (FIDs)
- Pitot tubes
- Downhole pressure and groundwater measuring equipment are currently under review by EG&G and may be included in the monitoring program.

5.0 LIMITATIONS

The following items are potential sources of uncertainty which will be controlled for the equipment listed in Section 4.0.

- Hand-held digital manometer: accuracy is 0.2 percent of full scale of high range at an operating temperature of 59 to 77 degrees F and goes to 0.3 percent for operating temperatures of 32 to 122 degrees F.

- Downhole pressure and groundwater measuring equipment: as yet to be determined

6.0 DOCUMENTATION OF ENVIRONMENTAL CONDITIONS

The following observations of environmental conditions will be recorded in the Scientific Notebook for each sampling/monitoring event.

- Air temperature
- Wind speed and direction (if outside of trailer)

When appropriate, the Health and Safety Technician will record environmental and health related conditions as specified in the Health and Safety Plan.

7.0 REQUIRED LEVEL OF PRECISION AND ACCURACY

The data needs to fulfill the SVE pilot test objectives are shown in Table 2-2 in the Final Pilot Test Plan (EG&G 1993b). The activities described in this SNP will meet these objectives.

8.0 THE SCIENTIFIC NOTEBOOK SYSTEM

All calibration and operational data will be recorded in a notebook which is permanently bound and pages numbered sequentially. Data will be recorded following guidelines set forth in draft RFP Administrative SOP 3-21000-ADM-5.10, "Use and Control of Scientific Notebooks." Information recorded shall also include the date and initials of the person making the entry. The Scientific Notebook document shall include all data acquired during field and laboratory operations to date. The recording of data that is suspect into the Scientific Notebook should be noted and qualified with a short paragraph stating why and how the investigator believes the data is suspect. Any alternatives to the method of data collection or procedures should also be recorded in the Scientific Notebook in such a manner that another qualified scientist can use the notebook to retrace the investigation to confirm the results, if feasible, or to repeat the experiment and achieve the same results without recourse to the PI. All relevant project data shall be transferred to a document format at the conclusion of field activities.

Field logbooks will be maintained by all personnel involved with performing project functions and will be part of the SNS. The logbooks will each have a unique identification number which is referenced in a master table of all SNS documents. Any computer software and data collected using that software shall be recorded in the Scientific Notebook. The location of data collected using a specified software, date, time, and name of investigator shall be carefully noted and recorded into the Scientific Notebook. Hard copies of experimental data shall be collected into a 3-ring binder in chronological order. This binder is considered as part of the Scientific Notebook System. Any data stored on the project computer shall be copied to a 3.25 in (1.44 mm) disk and placed into a file specified for this purpose. Directory and file names shall be recorded into the Scientific Notebook.

9.0 REFERENCES

EG&G. 1993a. Final Pilot Test Plan Soil Vapor Extraction Technology, Subsurface Interim Measures/Interim Remedial Action, East Trenches Area, Operable Unit No. 2. 2100-WP-OU02.027. January.

EG&G. 1993b. Final OU2 IM/IRA Implementation and Operation Plan Soil Vapor Extraction Pilot Test. RFP/ER-WP.OU2.5. October.

EG&G. EM Administrative Procedures Manual, Manual No. 3-21000-ADM, Procedure No. 5.10, Rev 0, draft F. Use of Controlled Scientific Notebooks.

Resource Technologies Group, Inc. (RTG). 1993. Mobile Soil Vapor Extraction Pilot Unit Operations and Maintenance Manual. Volumes 1-3.